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School Heads' Digital Leadership and Teachers' Digital Knowledge

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***Abstract*—** Successful technology application in education depends on the digital knowledge of teachers, which could be influenced by the digital leadership of school heads. This research was conducted to investigate the relationship between school heads' digital leadership and teachers' digital knowledge in the Maigo District, Lanao del Norte, Philippines. The study employed a descriptive-correlational design, involving 13 school heads and 115 teachers, with complete enumeration used to include the entire population. A self-constructed, validated, and pilot-tested questionnaire on digital leadership and digital knowledge was used to collect data, which were analyzed using mean, standard deviation, Pearson r, and Kruskal-Wallis tests. The results showed that most school heads were 41–50 years old, held a Master's degree, and had 16 years or more of service, while teachers were mostly 21–30 years old, had Master's units, and 1–5 years of service. School heads exhibited very high digital leadership (grand mean = 3.31) in the domains of Equity and Citizenship Advocacy, Visionary Planning, and Empowering Leadership. Teachers demonstrated very high digital knowledge (grand mean = 3.28) in areas such as TPACK and digital assessment. Pearson r analysis showed no significant relationship between school heads' digital leadership and teachers' digital knowledge ($r = -0.283$, $p = 0.650$). The Kruskal-Wallis test revealed that teachers' educational attainment significantly affected digital knowledge ($p = 0.034$), while age and length of service did not. These findings suggest that teachers' digital knowledge is largely influenced by self-directed learning and academic preparation, highlighting the need for teacher-focused professional development to support sustainable integration of technology in schools.

***Keywords*—** digital leadership, teachers' digital knowledge, teachers' digital competence, technology integration, professional development, educational leadership.

INTRODUCTION

Background of the Study

Today, education is becoming increasingly dependent on how effectively teachers can integrate technology into their teaching practices. Teachers' digital knowledge plays a vital role in enhancing instructional delivery, facilitating learner engagement, and improving overall teaching and learning processes. Digital knowledge refers to teachers' understanding of digital tools, platforms, and resources and how these can be used to support instruction, assessment, and learning activities. As schools continue to adapt to rapid technological changes, the conditions that support the development of teachers' digital knowledge have become a major concern in basic education.

Several studies have emphasized the importance of digital leadership in educational settings. Digital leadership involves guiding and supporting teachers in the use of technology, modeling effective digital practices, and fostering a culture that encourages innovation and collaboration (Karakose et al., 2021). Research has shown that school heads who actively demonstrate digital leadership positively influence teachers' confidence and engagement with digital tools, leading to improved understanding of how technology can be used in teaching and learning (A'mar & Eleyan, 2022). Likewise, teachers' digital knowledge has been identified as a key factor in successful technology integration, as it enables teachers to understand the pedagogical applications of digital resources in the classroom (Saubern et al., 2020).

Despite the growing body of literature on digital leadership and teachers' use of technology, gaps remain in existing research. Many studies focus on teachers' digital skills or attitudes toward technology without directly examining how school heads' digital leadership relates to teachers' digital knowledge. Moreover, limited studies have explored this relationship within the basic education context. Observations in schools indicate that even when digital tools and training are available, some teachers still struggle to understand and effectively use digital platforms, while school heads differ in the extent to which they model and promote digital practices. These conditions highlight the need for further investigation into the relationship between

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school heads' digital leadership and teachers' digital knowledge.

This study aims to examine the relationship between school heads' digital leadership and teachers' digital knowledge. Specifically, it seeks to describe the demographic profile of the respondents, determine the level of digital leadership demonstrated by school heads, and assess the level of digital knowledge of teachers. Furthermore, the study aims to establish whether a significant relationship exists between school heads' digital leadership and teachers' digital knowledge, and to determine whether significant differences are present when the variables are analyzed according to the respondents' demographic characteristics.

II. RESEARCH METHODOLOGY

Research Design

The study employed a descriptive–correlational research design, which aimed to describe existing conditions and determine the relationship between variables without manipulation or control. This design was appropriate because the study sought to examine the association between the digital leadership of school heads and the digital knowledge of teachers. The descriptive component was used to present the demographic profile of the respondents and the prevailing levels of school heads' digital leadership and teachers' digital knowledge, while the correlational component determined the extent to which these variables were related. As emphasized by Creswell and Creswell (2018), correlational research is useful in identifying the degree of relationship between variables and in providing a clearer understanding of how one factor may be associated with another. Through this design, the study was able to generate empirical evidence on the relationship between school heads' digital leadership and teachers' digital knowledge, which may serve as a basis for proposing appropriate interventions to enhance technology integration in schools.

Research Setting

The research was conducted in the Maigo District, a public school district in the province of Lanao del Norte, Philippines, under the supervision of the Department of Education (DepEd). The district consists of several elementary and secondary schools that vary in size, available resources, and level of technological infrastructure. Maigo District was considered an appropriate setting for this study as it represents a typical basic education context where digital transformation in school leadership and instruction is gradually being implemented. The diversity among schools within the district provided a realistic environment for examining the relationship between the digital leadership of school heads and the digital knowledge of teachers. Conducting the study in this district allowed for a meaningful assessment of how digital practices are promoted and supported by school heads and how these practices relate to teachers' digital knowledge within a local educational setting.

Research Respondents

The respondents of the study consisted of 115 teachers and 13 school heads from the Maigo District. Given that the total population was manageable, the study employed complete enumeration, wherein all members of the target population were included as respondents. This approach was utilized to ensure that the data accurately represented the entire group and provided a comprehensive view of the relationship between the digital leadership of school heads and the digital knowledge of teachers. According to Creswell and Creswell (2018), complete enumeration is appropriate when the population is accessible and relatively small, as it enhances the reliability of the results. By including all teachers and school heads in the district, the study minimized sampling bias and strengthened the credibility and generalizability of the findings within the research setting.

Research Instrument

The primary instrument used in this study was a self-constructed survey questionnaire designed to collect data on the digital leadership of school heads and the digital knowledge of teachers. The questionnaire utilized a 4-point Likert scale to measure respondents' perceptions, with 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, and 4 = Strongly Agree. It consisted of three parts: Part I gathered the demographic profile of the respondents, including age, highest educational attainment, and years of service; Part II assessed the digital leadership of school heads across dimensions such as equity and citizenship advocacy, visionary planning, empowering leadership, systems design, and connected learning; and Part III measured the digital knowledge of teachers, including content knowledge, pedagogical knowledge, technological knowledge, integration knowledge (TPACK), digital assessment knowledge, and digital support for students. This instrument was developed to obtain data necessary for

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examining the relationship between school heads' digital leadership and teachers' digital knowledge.

Data Gathering Procedure

The researcher followed a systematic and ethical procedure in collecting the data for the study. A formal request letter was first submitted to the Department of Education, Lanao del Norte Division to obtain permission to conduct the research in the Maigo District. Upon approval, coordination was made with the district supervisor and the school heads of the participating schools to facilitate the distribution of the survey questionnaires. The respondents, consisting of teachers and school heads, were provided with a consent letter explaining the purpose of the study, assuring confidentiality, and emphasizing that participation was voluntary. The questionnaires were personally administered by the researcher, who ensured that the respondents clearly understood the instructions and were given sufficient time to complete the instrument. After retrieval, all accomplished questionnaires were checked, coded, and prepared for statistical analysis.

Ethical Considerations

The study was conducted in accordance with ethical standards as outlined by Bell and Bryman (2007). The researcher ensured that no participants were subjected to any physical, emotional, or professional harm. Informed consent was obtained from all respondents prior to data collection, confirming that participation was voluntary and that respondents could withdraw at any time without any negative consequences. Personal identifiers were not collected, and the data were used solely for academic purposes, with confidentiality and anonymity strictly maintained. To ensure transparency, respondents were fully informed about the purpose and scope of the study. The researcher also maintained honesty and integrity in presenting the research findings, avoiding bias or manipulation of data, while upholding respect, accountability, and the academic intent of the study throughout all phases of the research.

Statistical Treatment

After the collection of all completed questionnaires, the data were analyzed using both descriptive and inferential statistics. Mean and standard deviation were computed to determine the general level and consistency of responses regarding the digital leadership of school heads and the digital knowledge of teachers, with the mean indicating the overall trend of responses and the standard deviation showing the degree of variation among respondents. Pearson's r was applied to determine the presence, strength, and direction of the relationship between school heads' digital leadership and teachers' digital knowledge. Additionally, the Kruskal–Wallis test was used to examine whether significant differences existed in the digital leadership of school heads and the digital knowledge of teachers when respondents were grouped according to demographic variables such as age, educational attainment, and years of service. This approach allowed for a comprehensive analysis of the relationship and differences in the study variables.

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III. PRESENTATION, ANALYSIS, AND INTERPRETATION OF DATA

Table 1. *Demographic Profile of the Respondents*

Profile	School Heads		Teachers	
	f	%	f	%
Age				
21-30 years	0	0.00	42	36.52
31-40 years	2	15.38	30	26.09
41-50 years	6	46.15	26	22.61
51 years and above	5	38.46	17	14.78
Total	13	100	115	100
Educational Attainment				
Bachelor's Degree	0	0.00	31	26.96
With Master's Units	0	0.00	43	37.39
Master's Degree Holder	8	61.54	27	23.48
With Doctoral Units	4	30.77	14	12.17
Doctoral Degree Holder	1	7.69	0.00	0.00
Total	13	100	115	100

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Length of Service				
1-5 years	0	0	36	31.30
6-10 years	2	15.38	32	27.83
11-15 years	5	38.46	25	21.74
16 years and above	6	46.15	22	19.13
Total	13	100	115	100

Table 1 shows the demographic profile of the respondents, which would consist of 13 school heads and 115 teachers of the Maigo District. The data are given in the terms of age, education level and years served.

With regard to age, most of the school heads (46.15%), were in the age group of 41 years to 50 years, then 38.46% were either 51 years or older, and 15.38% were 31 years to 40 years, with none in the age group 21 years and below. The largest proportion of teachers (36.52) were between 2130 years, the 2261 were 3140 years, the 26 were 4150 years, and the 14.78 were 51 years and above.

The researchers imply similar findings with Keržič et al. (2021), who discovered that younger teachers tend to be more proficient in using the ICT tools, given that those teachers were exposed to digital technologies earlier in their professional experiences.

On the same note, Li et al. (2025) found that the age factor also has a very strong impact on digital technology integration with younger teachers being more open and confident in using digital tools in the instructional settings.

In addition, Uzorka and Kalabuki (2025) pointed out that educational leaders should be aware of the generational variations of digital access as younger teachers tend to possess technological skills, and older leaders can offer strategic and visionary insights to balance innovativeness and experience in school leadership.

In terms of education, most of the school heads (61.54) have a Master's Degree, a smaller number (30.77) had a Doctoral Unit and the least (7.69) had a Doctoral Degree. The teachers comprised of 37.39% Master Unit owner, 26.96% Bachelor Degree owner, 23.48% Master Degree owner and 12.17% owner of Doctoral Units.

The result is corroborated by Balanquit et al. (2023) who found that professor members that had an advanced educational level show excellent performance results and high professional competence.

In a similar manner, Klingebiel and Klieme (2016) articulated that academic qualification plays a key role in determining the professional knowledge of teachers and classroom methods as well as the quality of instruction. In line with this, Uzorka and Kalabuki (2025) emphasized that the educational leaders of the digital age need a high level of academic preparation to be able to cope with technological integration and innovation-driven projects.

In the case of length of service, almost half of the school heads (46.15) had 16 years of service and above, 38.46 years of service 11-15 years of service, 15.38 years of service. Of the teachers, 31.30% was of 1 years to 5 years, 27.83% was of 6-10 years, 21.74% was of 11-15 years and 19.13% was of 16 years and above.

The findings align with the research by Graham et al. (2020) who emphasized that teaching experience is positively correlated with classroom quality and instructional effectiveness. Irvine (2019) also highlighted the fact that the experienced teachers should be more competent and flexible in pedagogy, whereas novice teachers usually bring the passion and innovativeness to the work of a teacher. In addition, Yang and Gong (2025) established that the classroom experience over the years is a significant predictor of teacher competence and reflective capacity especially when considering early education.

Table 2.1 *Level of School Heads' Digital Leadership in terms of Equity and Citizenship Advocate*

Indicators	SD	Mean
I promote equitable access to digital resources for all teachers and learners.	0.46	3.31
I ensure the responsible and ethical use of technology in teaching and learning.	0.46	3.31
I encourage digital inclusion among students regardless of background or ability.	0.46	3.69

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I implement policies that protect data privacy and support online safety.	0.49	3.38
I model good digital citizenship and guide teachers to do the same.	0.50	3.46
Grand Mean	3.43 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 2.1 provides the degree of digital leadership of the school heads in terms of Equity and Citizenship Advocate. The outcomes depict a grand mean of 3.43, which can be interpreted as Very High, and demonstrates that the practices are always strong, regardless of the indicator that is considered.

The highest mean is seen in Indicator 3, "I encourage digital inclusion among students regardless of background or ability" that had the largest mean of 3.69, which is understood as Very High. The indicators 1 and 2 had the lowest mean of 3.31 though this falls under the category of very high.

These results are corroborated by Liu et al. (2024), who have stressed that digital equity is a characteristic feature of school leadership in the post-digital generation when inclusivity and ethical digital practices are the key to the successful education system. On the same note, Normore and Issa Lahera (2020) contended that social justice leadership in education should focus on bridging the digital divide by providing equal access and developing ethical uses of technology to learners and educators. In line with this, Chavez et al. (2024) discovered that Filipino school heads who take an active role in promoting digital equity play a crucial role in advancing the digital competence of teachers, particularly when they support the inclusivity and digital responsibility of the learning environment.

Table 2.2 *Level of School Heads' Digital Leadership in terms of Visionary Planner*

Indicators	**SD**	**Mean**
I develop and communicate a clear digital vision aligned with the school's goals.	0.42	3.23
I integrate technology planning into the school improvement plan.	0.36	3.15
I support the implementation of ICT-based innovations in instruction.	0.42	3.23
I anticipate future digital trends that may impact the school's operations.	0.62	3.38
I allocate resources strategically to achieve sustainable digital transformation.	0.50	3.54
Grand Mean	3.31 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 2.2 shows the degree of school heads digital leadership as regards to Visionary Planner. The findings reveal a grand mean of 3.31, which is considered very high, that is, the school heads are continuously exercising leadership practices of digital visioning, strategic planning, and future-oriented decision-making.

The surprising observation is indicated in the score that means the highest mean, 3.54, which is verbalized as Very High, is in Indicator 5, "I allocate resources strategically to achieve sustainable digital transformation". In the meantime, Indicator 2, "I integrate technology planning into the school improvement plan" registered the lowest mean with 3.15, but this is still in the High category.

The results comply with Womack (2021), who discovered that visionary education leaders are resilient and farsighted by developing flexible technology plans that resonate with institutional objectives, particularly in times of crisis. Equally, Candrasari et al. (2023) have stressed that visionary leadership in education management is essential to attain the best performance in an institution through innovative thinking and progressive planning. Moreover, Umam (2024) has claimed that visionary leaders play a critical role in steering an educational institution through the digital transformation process by helping in promoting flexibility, critical thinking, and innovation.

Table 2.3 *Level of School Heads' Digital Leadership in terms of Empowering Leader*

Indicators	**SD**	**Mean**
I encourage teachers to confidently use technology in their lessons.	0.49	3.62
I provide mentoring and professional development opportunities on digital tools.	0.49	3.38

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I recognize and reward innovative teaching practices that use technology effectively.	0.50	3.46
I promote collaboration among teachers through digital platforms.	0.36	3.15
I create a supportive environment that allows teachers to experiment with new technologies.	0.50	3.46
Grand Mean	3.42	(Very High)

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 2.3 shows the degree of the digital leadership of school heads Empowering Leader. The calculated grand mean of 3.42, which can be referred to as Very High, shows that there is a strong practice overall through the indicators that pertain to the teacher empowerment, digital support, and encouragement to use technology in instruction.

The highest mean is observed under the Indicator 1, "I encourage teachers to confidently use technology in their lessons", where the mean of 3.62 is verbally interpreted as Very High. The lowest mean of 3.15 is observed in Indicator 4, which is "I promote collaboration among teachers through digital platforms", which is in the High category.

These results are consistent with Mushadi et al. (2025) who highlighted the importance of empowering teachers by mentoring and supportive leadership as it enhances their pedagogic competence and digital confidence.

Equally, Connolly et al. (2023) pointed out that good digital leaders maintain innovation by enabling educators to become the owners of their digital development by collaborating and engaging in continuous professional learning. Similarly, Enachescu and Costache (2025) observed that empowerment-based leadership can be significant in motivating, granting independence, and encouraging teachers in technology-based settings.

Table 2.4 *Level of School Heads' Digital Leadership in terms of Systems Designer*

Indicators	**SD**	**Mean**
I establish and maintain digital systems that support efficient school operations.	0.36	3.15
I monitor and evaluate the effectiveness of the school's digital initiatives.	0.47	3.08
I ensure the integration of ICT in both administrative and instructional functions.	0.42	3.23
I collaborate with ICT coordinators or personnel to sustain digital infrastructure.	0.53	3.15
I adapt existing school systems to align with emerging digital needs.	0.50	3.46
Grand Mean	3.22 (High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

The degree of digital leadership of the school heads, as Systems Designer, is presented in Table 2.4. The overall average of 3.22, which is interpreted as High, implies that school heads will do practices connected with designing, maintaining, and managing digital systems in their respective schools very often.

The largest mean can be found in Indicator 5, "I adapt existing school systems to align with emerging digital needs", with a value of 3.46, which can be rendered as Indicating a very high value.

In the meantime, the lowest mean of 3.08 can be found in the Indicator 2, which is the "I monitor and evaluate the effectiveness of the school's digital initiatives", which has a High category.

Such findings are justified by Luecha et al. (2022), who stressed that a successful school administrator is a system designer because he/she establishes organised digital spaces that promote the efficiency of instruction and administration. On the same note, Gonzalez-Zamar et al. (2020) emphasized the fact that sustainable education is based on leaders who can effectively handle ICT systems to deliver innovation and institutional development.

Going down to the Philippine context, Samosa (2025) suggested a digital framework of school leadership whose outcomes specifically highlight the significance of integrating technological infrastructure with the school management functionalities to create transformative and resilient learning spaces.

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Table 2.5 Level of School Heads' Digital Leadership in terms of Connected Learner

Indicators	SD	Mean
I actively participate in online professional learning communities.	0.27	3.08
I stay updated with current research and trends in digital education.	0.42	3.23
I network with other school leaders to share best digital practices.	0.55	3.00
I encourage teachers to pursue continuous digital learning and professional growth.	0.46	3.31
I use digital platforms effectively for communication and collaboration with stakeholders.	0.49	3.38
Grand Mean	3.20 (High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 2.5 shows the degree of digital leadership of school heads regarding Connected Learner. The calculated overall mean of 3.20 with the interpretation of a High value shows that the participation of digital professional learning practices, collaboration, and networking are common among school heads.

The highest mean value is indicated in Indicator 5, "I use digital platforms effectively for communication and collaboration with stakeholders", with a value of 3.38 which is considered as Very High. The mean lowest at 3.00 is found in Indicator 3, which is I network with other school leaders to share best digital practices and is interpreted as High.

These results are in line with Faizuddin et al. (2022), who stated that constant professional development courses help the school leaders to have the skills necessary to remain relevant in the 21st century especially in developing collaboration and digital aptitude. Similarly, Awodiji and Naicker (2023) said that the school heads should constantly be able to update their professional and technological competencies to stay effective in the fast-changing environment of the Fourth Industrial Revolution.

Table 2.6 Summary of the Level of School Heads' Digital Leadership

Domains	Mean	Interpretation
Equity and Citizenship Advocate	3.43	Very High
Visionary Planner	3.31	Very High
Empowering Leader	3.42	Very High
Systems Designer	3.22	High
Connected Learner	3.20	High
Grand Mean	3.31	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 2.6 presents the summary of the level of school heads digital leadership in five domains. The summed average of 3.31 which is assumed to be Very High signifies the school heads in the Maigo District having strong digital leadership practices on a regular basis.

The highest domain score is noted in Equity and Citizenship Advocate (3.43), whereas the lowest scores are located in Systems Designer (3.22) and Connected Learner (3.20) which are interpreted as High. The remaining domains, Visionary Planner (3.31) and Empowering Leader (3.42) are in the category of Very High.

The findings are justified by Luecha et al. (2022), who emphasized that school administrators are crucial to spearhead a digital transformation by introducing technology into the administrative and instructional practices in a strategic way. Besides, Awodiji and Naicker (2023) also pointed out that contemporary school leaders need to constantly improve their professional and technological skills to be efficient in the time of the Fourth Industrial Revolution. Equally, Samosa (2025) suggested that since school heads improve their digital leadership qualities, it would result in both efficiency and sustainability in school management.

Table 3.1 Level of Teachers' Digital Knowledge in terms of Content Knowledge in Digital Context

Indicators	SD	Mean
I know how to integrate technology in teaching my subject area.	0.69	3.36

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I can select digital resources appropriate to my learning content.	0.67	3.28
I can connect digital tools to enhance students' subject understanding.	0.58	3.18
I can modify learning materials using digital applications.	0.56	3.10
I understand how technology influences content delivery.	0.62	3.27
Grand Mean	3.24 (High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 3.1 shows the level of digital knowledge of the teachers in terms of Content Knowledge in Digital Context. The grand mean of 3.24 which is interpreted as High implies that the teachers often incorporate technology in their subject areas in order to facilitate good delivery of content.

An interesting outcome is observed with the first indicator, which is Indicator 1, "I know how to integrate technology in teaching my subject area" with the highest mean of 3.36, which can be explained as Very High. In the meantime, Indicator 4, which is "I can modify learning materials using digital applications" is the least mean with 3.10 which is interpreted as High.

These results align with the results of Schmid et al. (2021), as they found that the level of TPACK of teachers plays a significant role in their capacity to incorporate digital technologies in the process of lesson planning and content delivery. On the same note, Filgona et al. (2020) pointed out that good pedagogical content knowledge coupled with technological capabilities promotes effective teaching and leads to better student learning outcomes.

Table 3.2 *Level of Teachers' Digital Knowledge in terms of Pedagogical Knowledge in Digital Context*

Indicators	SD	Mean
I know various digital strategies for engaging students.	0.74	3.21
I can plan lessons that effectively use technology.	0.68	3.40
I can use technology to support different learning styles.	0.68	3.22
I can apply digital methods for collaborative learning.	0.66	3.27
I understand how to manage a technology-enhanced classroom.	0.65	3.35
Grand Mean	3.29 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 3.2 shows the degree of the digital knowledge of the teachers in Pedagogical Knowledge in Digital Context. The mean of 3.29, which may be interpreted as Very High, implies that the teachers often use digital pedagogical method in their teaching.

Another interesting outcome is obtained in the Indicator 2, "I can plan lessons that effectively use technology" where the highest mean is 3.40 and the interpretation is Very High.

On the contrary, Indicator 1, "I know various digital strategies for engaging students", has the lowest mean of 3.21 which is interpreted as High.

These findings are consistent with Toktarova and Semenova (2020), who emphasized that digital pedagogy obliges teachers to change the instructional design, assessment, and interaction strategies to digital learning settings.

On the same note, Dhakal (2023) stated that, efficient digital pedagogy facilitates engagement, collaboration, and creativity, which are important in 21st-century teaching. Besides, Pongsakdi et al. (2021) highlighted the importance of continuous training in digital pedagogy that improves teacher confidence and competence when instructing with the use of technology.

Table 3.3 *Level of Teachers' Digital Knowledge in terms of Technological Knowledge*

Indicators	SD	Mean
I can operate digital devices and educational software.	0.67	3.22
I can troubleshoot basic technical issues during instruction.	0.72	3.23
I am familiar with using productivity tools (e.g., Word, PowerPoint, Excel).	0.68	3.28
I can use internet-based applications for teaching.	0.61	3.36

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I can explore new technologies independently.	0.72	3.24
Grand Mean	3.26 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 3.3 shows the Technological Knowledge level of digital knowledge of the teachers. The grand mean of 3.26 which reflects Very High results in that the teachers show competence in using digital devices, applications and educational technologies.

One of the most important outcomes is the Indicator 4, which is "I can use internet-based applications for teaching", the highest mean of 3.36, which can be interpreted as very high. Conversely, Indicator 1, "I can operate digital devices and educational software" has the lowest mean of 3.22 which is taken to be High.

In accordance with this finding, Ayten (2021) reported that the technological knowledge of the teachers is an important element to be considered in achieving successful integration of technology into instruction since it helps them to choose and implement appropriate digital tools. In line with that, Sulaiman and Ismail (2020) pointed out that the technological competence is one of the main elements of 21st-century instructions that enable teachers to adjust to new learning conditions and develop digital literacy among students.

Table 3.4 *Level of Teachers' Digital Knowledge in terms of Integration Knowledge (TPACK)*

Indicators	SD	Mean
I can effectively blend technology, pedagogy, and content in teaching.	0.75	3.37
I can design lessons that integrate all three components of TPACK.	0.78	3.29
I can align learning objectives with appropriate digital tools.	0.67	3.40
I can adapt lessons using technology to improve outcomes.	0.67	3.38
I understand the connection between content, pedagogy, and technology.	0.70	3.30
Grand Mean	3.35 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 3.4 shows the level of digital knowledge of teachers in terms of Integration Knowledge (TPACK). The grand mean of 3.35 which can be interpreted as Very High means that teachers have high competency in terms of integrating technology, pedagogy and content in their teaching methods.

One of the most noticeable outcomes is Indicator 3, "I can align learning objectives with appropriate digital tools", with the highest mean of 3.40, which is regarded as the Very High score. In the meantime, Indicator 2, "I can design lessons that integrate all three components of TPACK" has the lowest mean of 3.29 that is also understood as Very High.

The presented findings are reinforced by Demissie et al. (2022) who stated that more digital competent teachers can successfully implement technological tools in teaching to enhance learning outcomes and engagement. Equally, Siloterio and Cajandig (2025) have reiterated that TPACK development of teachers is critical in the implementation of the modern curriculum since it increases their willingness to embrace the digital changes in pedagogy.

Table 3.5 *Level of Teachers' Digital Knowledge in terms of Digital Assessment Knowledge*

Indicators	SD	Mean
I know how to use online tools for student assessment.	0.74	3.32
I can design digital quizzes or tests aligned with learning objectives.	0.76	3.30
I can interpret results from digital assessment platforms.	0.81	3.24
I can use digital rubrics for performance tasks.	0.66	3.43
I know how to provide digital feedback to students.	0.68	3.32
Grand Mean	3.32 (Very High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

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Table 3.5 shows the degree of digital knowledge of teachers in Digital Assessment Knowledge. The grand mean of 3.32 that is interpreted as Very High shows that teachers are highly competent in their use of digital tools to assess student performance.

One of the most remarkable outcomes is the indicator 4, "I can use digital rubrics for performance tasks" with the highest mean of 3.43 that was evaluated as Very High. Conversely, the least mean of 3.24 is in Indicator 3, which is "I can interpret results from digital assessment platforms", and is considered to be High.

These results are in line with the works of Nguyen and Habo (2023), who highlighted that digital assessment literacy is one of the most important aspects of the overall digital competence of teachers. On the same note, Wayan Widana (2020) discovered that more digitally literate teachers are better placed to design assessments that are more likely to foster higher-order thinking skills. Besides that, Viberg et al. (2024) also emphasized that digital assessment proficiency is not limited to technical skills but also involves the capacity to interpret and use data to facilitate instruction.

Table 3.6 *Level of Teachers' Digital Knowledge in terms of Knowledge of Student Digital Support*

Indicators	SD	Mean
I can guide students in using digital tools safely and ethically.	0.87	3.24
I can help students troubleshoot digital learning difficulties.	0.55	3.24
I can recommend digital resources for student improvement.	0.71	3.24
I can teach students about online privacy and security.	0.67	3.21
I understand how to foster students' responsible digital behavior.	0.76	3.23
Grand Mean	3.23 (High)	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

Table 3.6 shows the degree of digital knowledge of teachers in the Knowledge of Student Digital Support.

The grand mean of 3.23, which is interpreted as High, shows that teachers often support the students in the responsible use of digital tools and resolving the digital learning difficulties.

An interesting finding is that Indicators 1, 2, and 3, the ability to guide students to use digital tools safely and ethically, the ability to assist students to troubleshoot the difficulties with digital learning and the ability to prescribe digital resources to students, all have the same highest mean of 3.24, which could be interpreted as High. On the other hand, Indicator 4, "I can teach students about online privacy and security" has the lowest mean of 3.21 also translated to High.

These results align with those of Tirado-Morueta et al. (2023), which puts a strong focus on teacher support in acquiring digital skills of students to be effective in technology-mediated learning.

In a similar way, Chanda et al. (2024) have pointed out that improving the digital literacy of educators equips students with the requirements of the current digital world. In line with this, Nagel (2021) also pointed out that the concept of digital competence must be incorporated into teacher education in order to develop responsible digital behavior among students.

Table 3.7 *Summary of the Level of Teachers' Digital Knowledge*

Domains	Mean	Interpretation
Content Knowledge in Digital Context	3.24	High
Pedagogical Knowledge in Digital Context	3.29	Very High
Technological Knowledge	3.26	Very High
Integration Knowledge (TPACK)	3.35	Very High
Digital Assessment Knowledge	3.32	Very High
Knowledge of Student Digital Support	3.23	High
Grand Mean	3.28	

Scale: 3.26 - 4.00 = Very High; 2.51 – 3.25 = High; 1.76 – 2.50 = Low; 1.00 – 1.75 = Very Low

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Table 3.7 provides a summary of the level of digital knowledge that teachers possess in six different domains, which resulted in a grand mean of 3.28, which can be interpreted as Very High. This shows that teachers are very competent in the use of digital knowledge in teaching and learning in technology-integrated settings.

One of the most striking outcomes is Integration Knowledge (TPACK) with the highest mean value (3.35) and the second rank Digital Assessment Knowledge (3.32), Technological Knowledge (3.26), both of which were identified as Very High. On the contrary Knowledge of Student Digital Support (3.23) and Content Knowledge in Digital Context (3.24) received the lowest means which are deciphered as High.

The corresponding results are consistent with those of Gomez-Trigueros (2023), who focused on the role of the mastery of TPACK by teachers to enhance digital instruction and encourage ethical and responsible use of technology. On the same note, Spiteri and Chang Rundgren (2020) observed that pedagogical confidence and knowledge of digital tools determine the application of digital technology by teachers. Moreover, Casillas Martinez et al. (2019) established that effective implementation of digital resources in classroom practices is more competent in teachers who have a high level of ICT knowledge and positive attitudes.

Table 4. *Test of Significant Relationship between School Heads' Digital Leadership and Teachers' Digital Knowledge*

Test Variables	Correlation Coefficient	P value	Decision
School Heads' Digital Leadership and Teachers' Digital Knowledge	-0.283	0.650	Retain the Ho

Note: If $p \leq 0.05$, with a significant relationship

Table 4 shows the significant relationship test between digital leadership of school heads and digital knowledge of teachers. The calculated correlation coefficient of -0.283 and p-value of 0.650 means that the relationship between the two variables is not significant since the p-value is above the level of significance 0.05. The null hypothesis is then retained.

This finding is reinforced by the authors Hafiza Hamzah et al. (2021) who discovered that although digital leadership by principals could create a favorable environment, digital competence of teachers largely depends on their willingness and their own interest in technology. In a similar manner, Liu and Liu (2021) observed that digital knowledge of teachers is highly dependent on individual factors, including self-efficacy, technology accessibility, and individual initiative. Moreover, Ata and Alpaslan (2024) also highlighted that motivation and digital literacy are the most crucial factors that add to the capabilities of teachers to embrace technology successfully.

Table 5. *Test of Significant Difference in the School Heads' Digital Leadership when Respondents are Grouped According to Demographic Profile*

Test Variables	P value	Decision
School Heads' Digital Leadership Vs. Age	0.274	Retain the Ho
School Heads' Digital Leadership Vs. Educational Attainment	0.418	Retain the Ho
School Heads' Digital Leadership Vs. Length of Service	0.196	Retain the Ho

Note: If $p \leq 0.05$, with a significant relationship

Digital Leadership vs. Age School Heads.

The analysis reveals that the p-value is 0.274, exceeding the 0.05 level of significance. This means that the difference between the digital leadership of school heads of various ages is not statistically significant.

Saeed and Kang (2024) support this finding by clarifying that leaders who are committed to digital innovation and capable of supporting teachers define their effective digital leadership and not the age. On the same note, Turan (2022) discovered that technology leadership behaviors of principals were associated more with their digital competencies and vision of digital transformation than with demographic factors. Also, Basilio, (2025) observed that age is not a significant factor in digital leadership, resilience, adaptability, and

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continuous learning emerged as better predictors of effective leadership in digital environments.

Digital Leadership of School Heads vs. School Leadership.

The results of the comparison between the digital leadership of school heads at varying levels of educational attainment generated p-value of 0.418 that exceeds the significance level of 0.05. This means that the difference in digital leadership in relation to education attainment is not statistically significant.

Muscid et al. (2025) support this finding by pointing out that digital leadership competence depends more closely on digital readiness and responsiveness to technological needs than on academic achievement. Likewise, Esogon and Gumban (2024) stressed that personal leadership traits and professional disposition are coupled with leadership effectiveness as opposed to the level of education. Basilio (2025) also observed that it is the capability-building, digital resilience, and strategic decision-making that influence the digital leadership outcomes as opposed to formal degrees.

Digital Leadership of School Heads vs. Length of Service.

The length of service analysis produced a p-value of 0.196 which is greater than the 0.05 threshold. It means that the level of differences between the digital leadership practices of school heads in relation to the years of their service is not statistically significant.

This result is in line with Esogon et al. (2024) who claimed that the effectiveness of leadership is associated with the capability of a school head to motivate and guide teachers and not with the years of experience.

In a similar manner, Saeed and Kang (2024) have discovered that digital leadership can influence the performance of teachers through the effect of the digital competence and engagement of the leader rather than tenure.

Turan (2022) also observed that technology leadership is better connected with the digital skills and proactive engagement of the principals with technology than with the time of their experience.

Table 6. *Test of Significant Difference in the Teachers' Digital Knowledge when Respondents are Grouped According to Demographic Profile*

Test Variables	P value	Decision
Teachers' Digital Knowledge vs. Age	0.157	Retain the Ho
Teachers' Digital Knowledge vs. Educational Attainment	0.034	Reject the Ho
Teachers' Digital Knowledge vs. Length of Service	0.089	Retain the Ho

Note: If $p \leq 0.05$, with a significant relationship

Digital Knowledge of Teachers vs. Age.

The result of the comparison between age gave a p-value of 0.157, which is more than the level of significance of 0.05. This means that the level of digital knowledge in teachers in the various age groups has no statistically significant difference.

Cabero-Almenara et al. (2021) support this finding by stating that age is not always a predictor of digital competence abilities, and access to digital means and involvement in training determine digital proficiency. Likewise, Momdjian et al. (2024) also discovered that the level of digital competence among teachers and student teachers was more influenced by training and experience as opposed to demographic factors like age. Another important issue noted by Dedebali (2020) is that the growth of digital literacy is dependent on digital exposure and learning spaces and not on age disparities.

Digital Knowledge of teachers vs. Educational Attainment.

The educational attainment analysis yielded a p-value of 0.034 which is less than the level of significance of 0.05. This implies that there is statistically significant difference in digital knowledge of the teachers in different groups in terms of educational attainment.

This is evidenced by the fact that teachers who have greater levels of education tend to have stronger digital competencies and greater digital literacy, which was found by Özdemir (2025). The same view was reflected by Shiri and Baigutov (2025) who observed that teachers of higher academic ranks are more masterful of TPACK since they have more academic interaction and specialized training. Dedebali (2020) also clarified that academic experiences and learning activities involving the utilization of digital tools also enhance digital literacy which may be the reason why teachers who are

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more educated demonstrate higher levels of digital knowledge.

Digital Knowledge vs. Length of Service of teachers.
The kind of comparison in terms of length of service gave a p-value of 0.089 which is more than 0.05. It means that the difference in the levels of digital knowledge of teachers between the various lengths of services is not statistically significant.

This observation concurs with Wu et al. (2022) who established that formal ICT training and school level support had a strong influence on digital competence among teachers compared to tenure. Also, it was reported by Momdjian et al. (2024) that when providing equal opportunities of digital learning, both in-service and pre-service teachers obtain comparable levels of digital competence. Cabero-Almenara et al. (2020) also added that digital competence is learnt through continuous learning and the experience of being involved in an online setting, rather than simply because of the years of teaching experience.

IV. SUMMARY OF FINDINGS, CONCLUSION, RECOMMENDATION

Summary of Findings
The results indicated that the 13 school heads were mostly in the 41–50 years age bracket (46.15%), followed by 51 years and above (38.46%), 31–40 years (15.38%), and 21–30 years (14.78%). Most of the school heads held a Master's degree (61.54%), some had Doctoral Units (30.77%), and others had a Doctoral degree (7.69%). Among the teachers, the majority had a Master's degree (37.39%), followed by a Bachelor's degree (26.96%), Master's degree (23.48%), and Doctoral Units (12.17%). Regarding length of service, most school heads had 16 years and above (46.15%), followed by 11–15 years (38.46%) and 6–10 years (15.38%), while teachers had 1–5 years (31.30%), 6–10 years (27.83%), 11–15 years (21.74%), and 16 years and above (19.13%).

The results revealed that school heads exhibited a Very High level of digital leadership in the areas of Equity and Citizenship Advocacy (3.43), Visionary Planning (3.31), and Empowering Leadership (3.42).

Meanwhile, the domains of Systems Design (3.22) and Connected Learning (3.20) were rated High, indicating slightly lower but still strong digital leadership in these areas. Overall, the school heads achieved a grand mean of 3.31, classified as Very High, reflecting consistent digital leadership practices across the five domains.

The findings indicated that teachers demonstrated Very High levels of digital knowledge in the areas of Pedagogical Knowledge in Digital Context (3.29), Technological Knowledge (3.26), Integration Knowledge or TPACK (3.35), and Digital Assessment Knowledge (3.32). Content Knowledge in Digital Context (3.24) and Knowledge of Student Digital Support (3.23) were rated High. The overall grand mean of 3.28, considered Very High, suggests that teachers possess substantial digital knowledge necessary for technology-enhanced teaching and learning.

The correlation analysis showed that the relationship between the digital leadership of school heads and the digital knowledge of teachers had a correlation coefficient of -0.283 with a p-value of 0.650. Since the p-value exceeds the 0.05 level of significance, the result indicates no statistically significant relationship between the two variables. This suggests that teachers' digital knowledge does not significantly vary in relation to the digital leadership practices of school heads.

The findings indicated that there was no significant difference in the digital leadership of school heads when grouped according to age, educational attainment, and length of service, with p-values of 0.274, 0.418, and 0.196, respectively. These results suggest that demographic characteristics of school heads do not influence their digital leadership practices.

The analysis revealed that teachers' digital knowledge did not significantly differ based on age ($p = 0.157$) or length of service ($p = 0.089$). However, a significant difference was found when teachers were grouped by educational attainment ($p = 0.034$), indicating that educational level is the only demographic characteristic associated with variations in teachers' digital knowledge.

Conclusions
This research concludes that the digital leadership of school heads has no direct effect on the digital knowledge of teachers. This suggests that teachers acquire their digital knowledge primarily through personal training, exposure to technology, and self-directed learning rather than through administrative influence. Consequently, to enhance teachers' digital preparedness, teacher-centered and needs-specific professional development programs should be

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implemented. Overall, the results underscore the importance of strengthening teacher-oriented digital capacity-building to support meaningful and sustainable technology integration in schools.

Recommendations

Teachers. Teachers are encouraged to enhance their digital knowledge by engaging in professional learning and exploring technology. They should seek opportunities for training, familiarize themselves with digital tools applicable to their classroom settings, and collaborate with colleagues to improve instructional methods and support learners effectively in a technology-enhanced environment.

School Administrators. School heads and administrators should provide targeted digital training programs and learning opportunities that directly address the digital knowledge needs of teachers, as improvements in teachers' digital knowledge cannot be assumed to result automatically from leadership practices. They should also ensure the availability of sufficient resources, mentoring, and school policies that support ongoing digital development among teachers.

DepEd Officials. Officials of the Department of Education should design and implement policies that promote the development of digital leadership in school heads and enhance teachers' digital knowledge. To strengthen digital skills in schools, they should allocate adequate funding, provide access to technology, and organize well-structured professional development programs.

Policy Makers. Policy makers need to establish education policies that encourage innovation, digital equity, and responsible use of technology in schools. They should consider incorporating technology standards and leadership models, such as the ISTE Standards for Education Leaders, into policy frameworks to support digital transformation initiatives in schools.

Future Researchers. Future studies should investigate other factors that may influence teachers' digital knowledge, since digital leadership did not show a significant impact in the present study. Variables such as availability of technology, professional development experiences, institutional digital culture, and schoolwide technology programs could be explored.

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